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TRANSMISSION METHOD OF HALFTONE IMAGE DATA

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[Title of the Invention] Transmission method of halftone image data

[Abstract]

[Object]

To provide a transmission method of halftone image data that can speed up an image data communication in a facsimile machine.

[Constitution]

The sending side S is configured to divide dot data of a plurality of read lines into a dot matrix 1 in a predetermined size and convert dot matrix 1 divided as such into density information 2 and transmit the density information 2, while receiving side R is configured to convert the sent density information 2 into dot pattern 3 and print the dot pattern 3 out.

[Claims]

[Claim 1]

A method of transmitting halftone image data characterized in that a sending side divides dot data of a plurality of read lines into a dot matrix in a predetermined size, converts the dot matrix divided as such into density information, and transmits the density information, while a receiving side converts the sent density information into a dot pattern and prints the dot pattern out.

[Claim 2]

The method of transmitting halftone image data according to claim 1, characterized in that the receiving side has a conversion table which has stored dot patterns according to density information for each of density information sizes of dot matrices, wherein each time the receiving side receives density information from the sending side, the receiving side refers to said conversion table, converts the information into a dot pattern.

[Claim 3]

The method of transmitting halftone image data according to claim 1, characterized in that when the receiving side converts the density information received from the sending side into a dot pattern, the receiving side converts the density information into a dot pattern with consideration of surrounding density information on the basis of the received density information and prints the dot pattern out.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a transmission method of halftone image data performed to speed up an image data communication in a facsimile machine.

[0002]

[Prior Art]

As a transmission method of halftone image data in a facsimile device, a transmission method so-called a binary

dithering method, such as a pseudo gradation displaying method or a difference diffusing method is conventionally known. For example, a binary dithering method is to identify shading of multiple grades by altering density of black pixels within a small area, wherein each pixel has two values of white and black: For example, with a dot matrix of 4 × 4 pixels being a unit of gradation display, 16 grades can be provided by changing the threshold for determining white or black for each pixel within the matrix.

[0003]

In the image transmission with this binary dithering method, image data of four lines is stored in memory, then white and black determination for each pixel within a dot matrix of 4 (in the main scanning direction) × 4 (in the counter scanning direction) pixels. After this operation is completed for the width of one line, the coded data is transmitted to the facsimile on the other side.

[0004]

[Problems to be Solved by the Invention]

However, in the above-mentioned transmission method of halftone image data, white and black pixels frequently alternated in the halftone image data, which leads a problem of longer communication period with low compression rate even after encoding. The present invention is proposed in view of such circumstance, and intends to provide a transmission method of halftone image data that speeds up a transmission of image data in a facsimile device.

[0005]

[Means for Solving the Problems]

According to the present invention according to claim 1, which is proposed to achieve the above-mentioned object, a sending side divides dot data of a plurality of read lines into a dot matrix in a predetermined size, converts the dot matrix into density information, and transmits the density information. On the other hand, a receiving side converts the sent density information into a dot pattern and prints the dot pattern out. The density information refers to the number of black pixels within a dot matrix. For example, 17 types of density information, 0-16, may occur for a dot matrix in the size of 4 × 4.

[0006]

In the present invention according to claim 2, the receiving side has a conversion table which has stored dot patterns according to density information for each of density information sizes of dot matrices. Each time the receiving side receives density information from the sending side, it refers to the conversion table, converts the information into a dot pattern. In the present invention according to claim 3, when the receiving side converts the density information sent from the sending side into a dot pattern, the receiving side converts the density information into a dot pattern with consideration of surrounding density information on the basis of the received density information and prints the dot pattern out.

[0007]

[Operation]

With a transmission method of halftone image data according to claim 1 of the present invention characterized by the above-mentioned configuration, the sending side divides dot data of a plurality of read lines into a dot matrix in a predetermined size, converts the dot matrix into density information and transmits the information. On the other hand, the receiving side converts the sent density information into a dot pattern and prints the dot pattern out.

[0008]

With a transmission method of halftone image data according to claim 2 of the present invention, each time the receiving side receives density information from the sending side, it refers to the conversion table, converts the information into a dot pattern corresponding to the density information and the size of the dot matrix. With a transmission method of halftone image data according to claim 3, when the receiving side converts the density information sent from the sending side into a dot pattern, the receiving side converts the density information into a dot pattern with consideration of surrounding density information on the basis of the received density information and prints the dot pattern out.

[0009]

[Embodiments]

An embodiment of the present invention will be described in conjunction with drawings. Figure 1 is a diagram illustrating an exemplary method of transmitting halftone image data according to the present invention. The sending side S divides dot data of a plurality of read lines into a dot matrix 1 in a predetermined size. In Figure 1, four lines are divided by four dots, which form 4 × 4 dot matrix 1. The divided dot matrix 1 is converted into density information 2 and transmitted. As density information 2, numeric information of the number of black pixels within the dot matrix, for example "8", may be used.

[0010]

On the other hand, receiving side R converts the sent density information 2 into dot pattern 3 and prints dot pattern 3 out. The dot pattern 3 has been stored in conversion table 4 (see Figure 2) for density information 2 and the size of dot matrix 1. Each time density information 2 is sent from sending side S, conversion table 4 is referred to, and density information 2 is converted into dot pattern 3 and printed out (claims 1, 2).

[0011]

Figure 2 shows an example of the above-mentioned conversion table 4. In Figure 2, a single dot pattern 3 is stored for a single piece of density information 2, though a plurality of dot patterns 3 may be stored for random selection. In order to further speed up the conversion of halftone image data in this method according to the present

invention, dot pattern 3, best matched for features of the image, can be selected and printed out, if surrounding density information 2 is considered when receiving side R converts the received density information 2 into a dot pattern 3 and prints it out. Claim 3 proposes such a method, which is employed in high end devices. In such a case, receiving side R needs only to prepare conversion table 4, which has stored various dot patterns 3 for surrounding density information pattern. When density information 2 is converted into dot pattern 3, conversion table 4 is referred to and dot pattern 3 is printed out.

[0012]

In this method, dot matrix 1 to be converted into dot pattern 3 is considered as a matrix of interest, and dot pattern 3 with image corrected and highlighted based on density information patterns of surrounding matrices is provided. Density information 2a of a matrix of interest shown in Figure 3 selects dot pattern 3 from conversion table 4 based on patterns of density information 2b of surrounding matrices. In Figure 3, since density information 2a of a matrix of interest is "8" and all the density information 2b of surrounding matrices is "8" as density information 2a of the matrix of interest, dot pattern 3 with uniform black pixels is selected as dot pattern 3 to be converted.

[0013]

Figure 4 shows a case, in which a pattern of density information 2b of the above-mentioned surrounding matrices

is different from that of Figure 3. Since all the density information 2b of surrounding matrices shown in Figure 4 (a) is density information 2, which is lower than density information 2a of the matrix of interest, dot pattern 3 with black pixels gathering in the center is selected. Since all the density information 2b of surrounding matrices shown in Figure 4 (b) is density information 2, which is higher than density information 2a of the matrix of interest, dot pattern 3 with black pixels dispersed around is selected. And since the upper part of density information 2b of surrounding matrices shown in Figure 4 (c) is density information 2, which is lower than density information 2a of the matrix of interest, left and right sides are the same as density information 2, and the lower part is higher density information 2, dot pattern 3 with black pixels gathering in the lower part is selected.

[0014]

Density information 2a of a matrix of interest is converted into various dot patterns 3 with black pixels gathering, for example, in the upper part, left side, right side, in the upper left corner, or in the lower right corner, on the basis of a pattern of density information 2a of surrounding matrices. Next, the above-mentioned transmission procedure will be described with a flow chart. Steps 100-109 shown in Figure 5 represent a flow chart showing an exemplary facsimile transmission procedure at sending side S, in which after dot data of four lines are read, dot

matrix 1 of 4 × 4 is created and converted into density information 2, which is then sent sequentially.

[0015]

Steps 200-212 shown in Figure 6 represent a flow chart showing an exemplary facsimile transmission procedure at receiving side R. A size of dot matrix 1 is received according to a facsimile communication procedure (step 201), then density information 2 is received sequentially. Printing process starts in parallel when density information 2 is done. When density information 2 has been stored for three matrices in the counter scanning direction, it is converted into dot pattern 3 with consideration of surrounding density information 2, and printed out line by line. Although density information 2b of surrounding matrices is assumed as density information 2 of eight surrounding matrices here, dot pattern 3 may be selected based on density information of more matrices, or dot pattern 3 may be selected based on density information of matrices less than eight, such as density information 2 of matrices at the end of a line.

[0016]

Size of a dot matrix 1 described in the embodiment is not limited to the above description and a transmission method of halftone image data of the present invention can be provided in size of 3 × 3, 3 × 4, or 4 × 3, other than 4 (in the main scanning direction) × 4 (in the counter scanning direction).

[0017]

[Advantages of the Invention]

As it is apparent from the above description, advantages as below are provided according to the present invention. With a transmission method of halftone image data according to claim 1, halftone image can be printed out at the receiving side when the sending side merely sends density information. This improves transmission efficiency with smaller transmission data and shorter transmission time.

[0018]

With a transmission method of halftone data according to claim 2, various dot patterns can be printed out if the receiving side stores dot patterns for density information and the size of a dot matrix in a conversion table. This enables automatic alteration of accuracy of the halftone image to be printed out. With a transmission method of halftone image data according to claim 3, the receiving side can convert into dot pattern with consideration of surrounding density information. This enables high end devices to correct an original image and print out halftone image with features highlighted more sharply.

[Brief Description of the Drawings]

[Figure 1]

Figure 1 is a diagram illustrating an exemplary method of transmitting halftone image data.

[Figure 2]

Figure 2 is a diagram illustrating an exemplary inside structure of a conversion table.

[Figure 3]

Figure 3 is a diagram illustrating a dot pattern conversion with consideration of surrounding density information.

[Figure 4]

Figure 4 is a diagram illustrating another example of a dot pattern conversion with consideration of surrounding density information.

[Figure 5]

Figure 5 is a flow chart showing an exemplary facsimile transmission procedure at sending side.

[Figure 6]

Figure 6 is a flow chart showing an exemplary facsimile transmission procedure at receiving side.

[Description of Symbols]

1 Dot matrix

2 Density information

2a Density information of matrix of interest

2b Density information of surrounding matrices

3 Dot pattern

4 Conversion table

S Sending side

R Receiving side

Figure 1

S SENDING SIDE

R RECEIVING SIDE

#1 CONVERT

#2 SEND

Figure 2

#1 SIZE OF DOT MATRIX

#2 DENSITY INFORMATION

#3 DOT PATTERN

Figure 5

100 DIAL UP, FACSIMILE COMMUNICATION PROCEDURE

101 READ IMAGE FOR ONE LINE

102 ACCUMULATE LINE MEMORY

103 IMAGE READ FOR FOUR LINES?

104 CREATE DOT MATRIX

105 CONVERT DENSITY INFORMATION

106 SEND DENSITY INFORMATION

107 PERFORMED FOR WIDTH OF ONE LINE?

108 END OF IMAGE DATA?

109 SEND OUT EOP

Figure 6

#1 RECEIVING PROCESS

200 RECEIVED?

201 FACSIMILE COMMUNICATION PROCEDURE

202 RECEIVE DENSITY INFORMATION

203 EOP RECEIVED?

#2 PRINTING PROCESS

204 DENSITY INFORMATION RECEIVED?

205 ACCUMULATE DENSITY INFORMATION

206 ACCUMULATED FOR THREE MATRICES?

207 READ DENSITY INFORMATION OF MATRIX OF INTEREST

208 REFER TO DENSITY INFORMATION OF SURROUNDING MATRICES

209 CONVERT INTO DOT PATTERN

210 CONVERTED FOR ONE LINE?

211 PRINT FOR ONE LINE

212 DENSITY INFORMATION REMAINS?

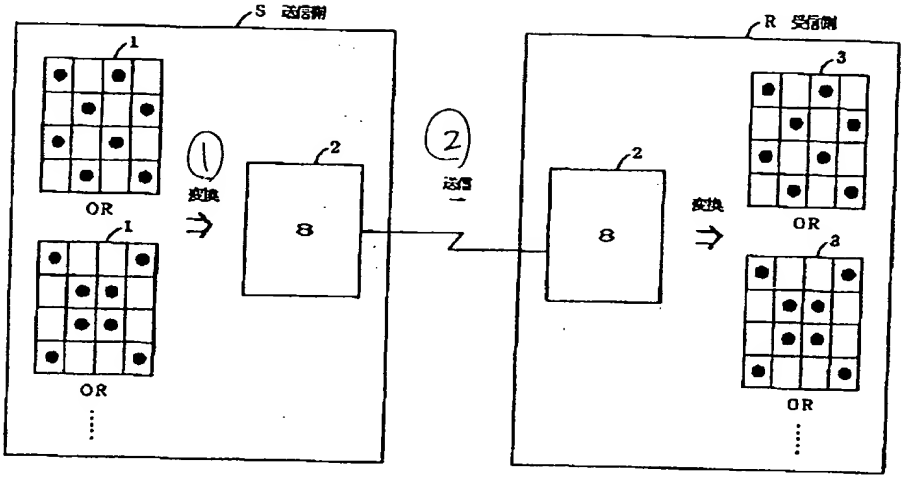
5　　6

フローチャートである。

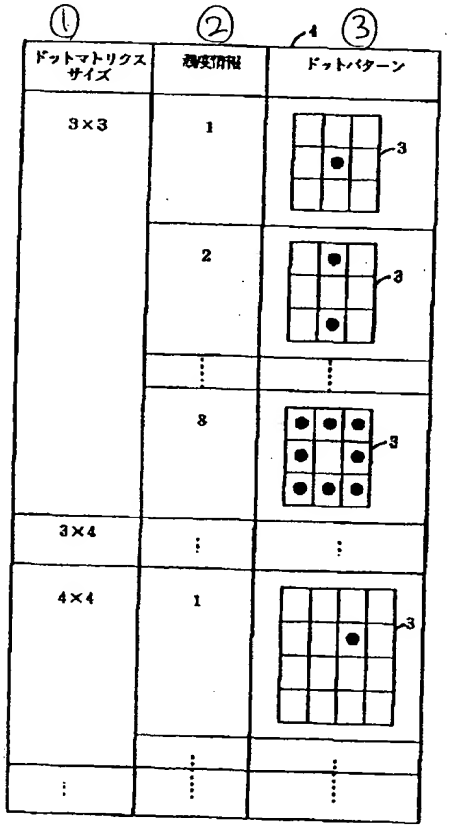
【符号の説明】

1　ドットマトリクス
2　濃度情報
2 a　注目マトリクスの濃度情報
2 b　周囲のマトリクスの濃度情報
3　ドットパターン
4　変換テーブル
S　送信側
R　受信側

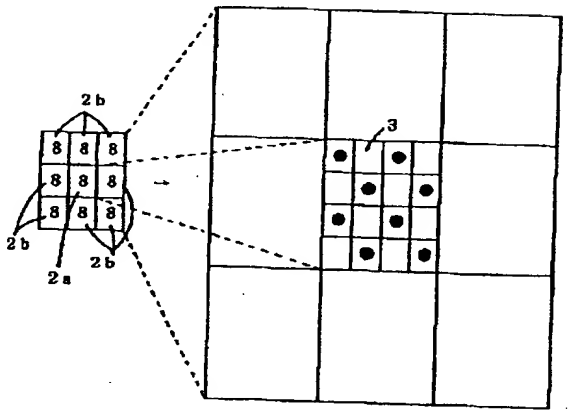
【図１】 Fig. 1



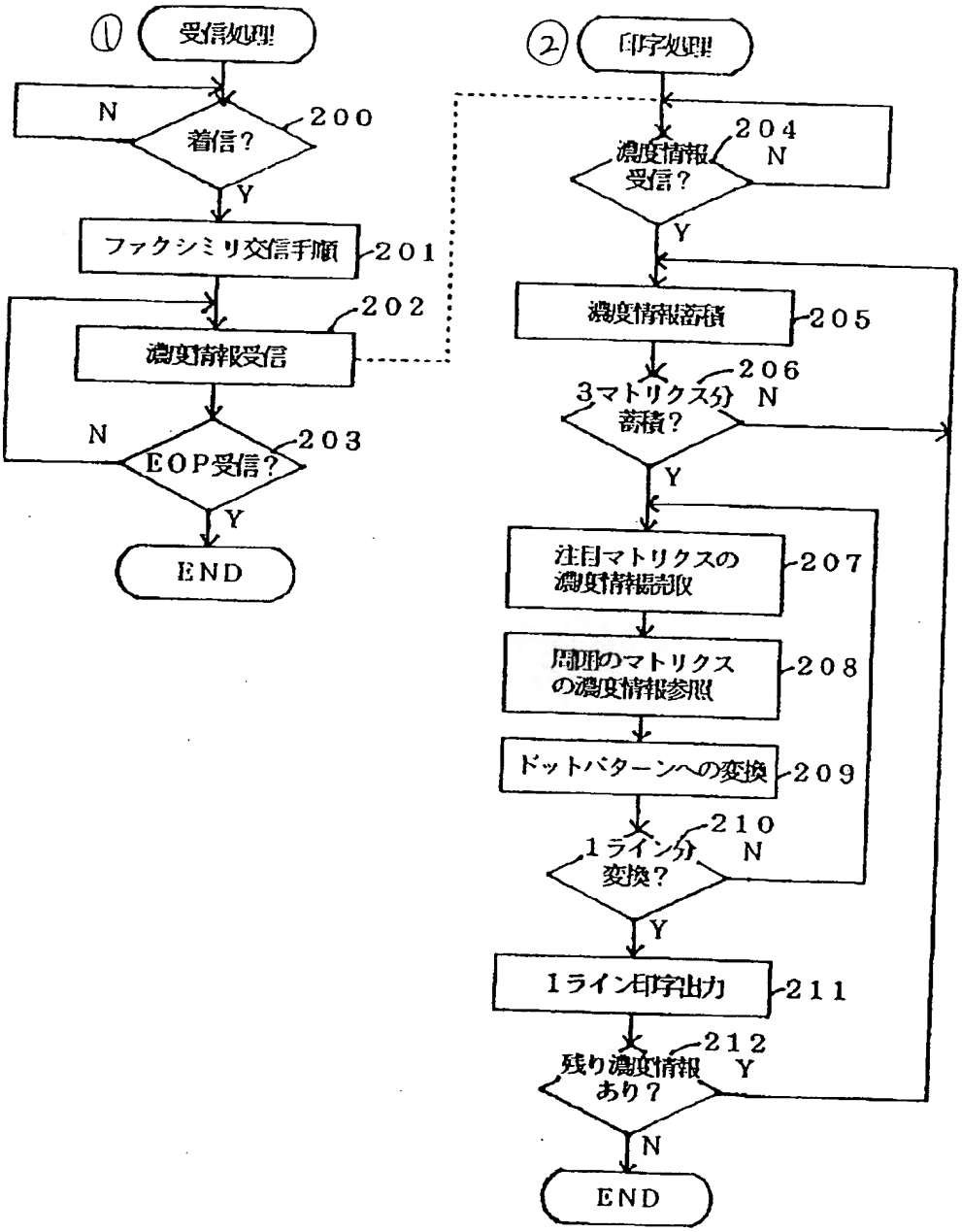
【図２】 Fig. 2



【図３】 Fig. 3



【図６】　Fig. 6


①
受信処理
N
着信？
200
Y
ファクシミリ交信手順
201
202
濃度情報受信
N
EOP受信？
203
Y
END
②
印字処理
濃度情報受信？
204
N
Y
濃度情報蓄積
205
3マトリクス分蓄積？
206
N
Y
注目マトリクスの濃度情報読取
207
周囲のマトリクスの濃度情報参照
208
ドットパターンへの変換
209
1ライン分変換？
210
N
Y
1ライン印字出力
211
残り濃度情報あり？
212
Y
N
END